

CLAIMS

What is claimed is:

1. A heating element, comprising:

5 a first heat sink having at least one opening, wherein a fluid pathway is formed
through said first heat sink; and
 at least one PTC element thermally coupled to the first heat sink and having a current
direction, wherein the at least one PTC element is substantially aligned such that said current
direction is substantially parallel to said fluid pathway.

10 2. The heating element of Claim 1, wherein said first heat sink includes thermally
conductive material and is positioned such that said at least one PTC element transmits
heat to said first heat sink.

15 3. The heating element of Claim 2, wherein said thermally conductive material comprises
at least one of copper, stainless steel, and steel.

 4. The heating element of Claim 1, wherein said at least one PTC element is substantially
shielded from said fluid pathway.

20 5. The heating element of Claim 4, wherein said at least one PTC element has a surface
area and said fluid pathway is adjacent to less than 50% of the surface area of said at
least one PTC element.

6. The heating element of Claim 4, wherein said first heat sink includes solid portions, and said solid portions of said first heat sink are aligned over said at least one PTC element such that said solid portions of said first heat sink substantially shield said at least one PTC element from being in the fluid pathway.

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7. The heating element of Claim 1, comprising a plurality of PTC elements radially arranged within a circle.

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8. The heating element of Claim 7, wherein said radial arrangement comprises a plurality of radial flanges, and at least one radial flange includes a plurality of PTC elements.

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9. The heating element of Claim 1, further comprising a second heat sink attached to said first heat sink, wherein said first and second heat sinks include electrically conductive material, and said at least one PTC element electrically contacts both said first and second heat sinks.

10. The heating element of Claim 9, wherein said first and second heat sinks are configured to carry an electric supply to and from said at least one PTC element.

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11. The heating element of Claim 10, further comprising fasteners which attach said first heat sink to said second heat sink and electrically isolate said first heat sink from said second heat sink, wherein said fasteners are located and configured to generate pressure between said first and second heat sinks and said at least one PTC element.

12. The heating element of Claim 10, comprising a plurality of PTC elements, each having a surface area, arranged radially within a circle, such that said fluid pathway is adjacent to less than 50% of said surface area of said plurality of PTC elements.

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13. The heating element of Claim 12, wherein said plurality of PTC elements are rectangular in shape.

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14. The heating element of Claim 13, wherein said first and second heat sinks include openings for permitting fluid flow and wherein said plurality of PTC elements are positioned at least partially away from said openings.

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15. The heating element of Claim 12, wherein said heating element is configured such that at least one of said heat sinks substantially shields said plurality of PTC elements from said fluid pathway.

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16. The heating element of Claim 12, wherein said radial arrangement comprises radial flanges, and said plurality of PTC elements is arranged such that there is more than one PTC element in at least one radial flange.

17. The heating element of Claim 10, further comprising conductive grease between said plurality of PTC elements and said first and second heat sinks.

18. The heating element of Claim 1, further comprising a second heat sink attached to said first heat sink and thermally coupled to said at least one PTC element, wherein said at least one PTC element transfers at least 80% of its heat output to said heat sinks.

5 19. The heating element of Claim 1, wherein said at least one PTC element is rectangular in shape.

10 20. The heating element of Claim 1, comprising a plurality of PTC elements arranged such that broad surfaces of the plurality of PTC elements are aligned in a plane substantially perpendicular to said fluid pathway.

21. The heating element of Claim 1, wherein said heating element is sized to fit a portable space heater.

15 22. A heater, comprising:

a housing;

the heating element of Claim 1; and

an air circulator which generates an fluid flow that is directed substantially through said fluid pathway.

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23. The heater of Claim 22, wherein said first heat sink includes thermally conductive material such that said at least one PTC element transmits heat to said first heat sink.

24. The heater of Claim 22, wherein said at least one PTC element has a surface area, and
said first heat sink defines said fluid pathway adjacent to less than 50% of the surface area
of said at least one PTC element.

5 25. The heater of Claim 22, comprising a plurality of PTC elements radially arranged within
a circle.

26. The heater of Claim 22, wherein:

10 said first heat sink includes electrically conductive material;
said at least one PTC element electrically contacts said first heat sink; and
said first heat sink is configured to carry an electric supply at least one of to and from
said at least one PTC element.

27. A heating element comprising:

15 a first heat sink having at least one opening formed through the heat sink, wherein a
fluid pathway is formed through said first heat sink; and

a PTC element thermally coupled to the first heat sink, the PTC element positioned
substantially out of said fluid pathway and so that a largest surface area of the PTC element
is approximately perpendicular to the fluid pathway.

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28. The heating element of Claim 27, wherein said first heat sink includes a thermally
conductive material, such that said PTC element transfers heat to said first heat sink.

29. The heating element of Claim 28, wherein said first heat sink includes at least one of copper, stainless steel, and steel.

30. The heating element of Claim 27, comprising a plurality of PTC elements radially
5 arranged within a circle.

31. A heating element comprising:

at least one heat sink having at least one opening formed in the at least one heat sink,
wherein a fluid pathway is formed through said at least one opening in the at least one heat
10 sink; and

a PTC element thermally coupled to the at least one heat sink such that at least 50%
of the heat output by said PTC element is transferred to heat sinks coupled to the PTC
element, and arranged so that a largest surface of the PTC element is approximately
perpendicular to said fluid pathway.

32. The heating element of Claim 31, wherein said PTC element transfers at least 80% of its
heat output to said first heat sink.

33. The heating element of Claim 31, comprising a plurality of PTC elements arranged
20 radially within a circle.

34. A heating element, comprising:

a first heat sink having at least one opening;

a second heat sink attached to said first heat sink and having at least one opening, wherein a fluid pathway is formed through said first and second heat sinks by way of said openings; and

5 a plurality of PTC elements each having a current direction and radially arranged inside a circle, wherein the plurality of elements is substantially aligned in a single plane between the first and second heat sinks such that said current direction in said plurality of PTC elements is substantially parallel;

wherein said first and second heat sinks are configured to act as electrodes for said plurality of PTC elements.

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35. A heating element, comprising:

a heat sink having at least one opening wherein a fluid pathway is formed through said heat sink; and

at least one PTC element in thermal communication with said heat sink, the heat sink
15 and at least one of the PTC elements arranged such that said fluid pathway first passes one of said heat sink and said at least one PTC element and then passes the other of said heat sink and said at least one PTC element.